PULL, PUSH, OR SHOVE: GLOBAL BROADCAST SERVICE AND INTELLIGENCE SUPPORT TO MARITIME FORCES

A MONOGRAPH
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The Department of Defense developed the Global Broadcast Service (GBS) to increase the amount of national and theater level information provided to deployed forces, resolving some shortcomings in information dissemination identified during the Gulf War. Using direct broadcast satellite technology, GBS is expected to deliver information at rates exponentially faster than what is available now.

The broadcast service makes possible the near-simultaneous transfer of critical information to multiple users. While GBS may speed the flow of information, it does nothing to improve the quality of intelligence. Given the large capacity of GBS, intelligence managers may be under unreasonable pressures to release information to fill available bandwidth. The result could be more raw information for commanders, and less finished intelligence.

GBS has constraints and limitations inherent in its design. Not all users in a theater will have access to high-capacity bandwidth at the same time. Where the GBS broadcast beams are positioned will determine who gets what level of GBS bandwidth. Naval forces deploying into an area of operations could experience as many as five variations on broadcast support from the service. Theater CINCs will have to share GBS resources, and the system probably will not be able to support multiple crises in the same theater at the same time.

The small antenna size of GBS receive suites allow the lowest-level tactical forces to receive intelligence support previously only available at the flag-level. Tactical forces will also have access to vastly greater amounts of data. Passive recipients of large broadcast products may experience information overload and other unintended negative consequences. To make the best use of the technology, under the proposed dissemination architecture intelligence planners must take the time actively manage the flow of information they receive.

GBS offers new and unique dissemination capabilities. Theater intelligence centers do not plan to dedicate significant intelligence production for the broadcast. Users seeking to fill gaps in their knowledge may find the formal dissemination architecture inefficient in response to direct or ad-hoc requests. The web-based architecture of Intelink provides a known and familiar method for users to find and retrieve needed intelligence. Theater intelligence centers dedicate a significant portion of their production effort to supporting Intelink. Providing a GBS connection to Intelink would allow users to browse for information interactively. This would be an efficient way for deployed forces to find intelligence not available by scheduled broadcast, and allow them to scale their requests based on available bandwidth.

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I. INTRODUCTION

At the turn of the century, in 1999, well into the Information Age, Naval forces are making do with unsatisfactory communications systems. The amount of information available and needed has grown exponentially since the Gulf War, while communications in support struggles to keep up. Digital intelligence imagery, weather photos from satellites, an ever-expanding daily air tasking order, and scores of other data crowd existing U.S. Navy communications pathways. As a result, deployed maritime forces experience significant delays in receipt of important message traffic, and receive only a few digital images daily.

The Department of Defense developed the Global Broadcast Service (GBS) to increase the amount of national and theater level information provided to deployed forces. Funding was approved in December of 1995 for a three-phase program under the GBS Joint Program Office. The GBS will use direct broadcast satellite technology to deliver data at rates exponentially larger than what was available previously.[1]

Current commercial satellite broadcasting technology uses satellite-based transponders that communicate with individual users via terminals with 18-inch (TV) or 24-inch (data) antennas. GBS applies this technology to meet the DoD requirement for high-volume information transfer to the warfighter. These broadcasts enable timely delivery of large data file products to small, easily transported, and affordable tactical terminals. Given the small size of the receivers and their affordable commercial design, the system should be deployable to more users at lower command levels than possible with existing military satellite systems.[2]

GBS will be a system of information sources, uplink sites, broadcast satellites,

and receiver terminals, as well as management processes for requesting and coordinating the distribution of information products. Each GBS satellite in a global constellation will be served by a primary uplink site where information products will be assembled and transmitted to a high-powered satellite for relay over a large geographic area. In addition, GBS will have the capability to take products from the theater it serves and inject them directly to the satellite for broadcast throughout the theater. What makes GBS so attractive is its ability to provide high volume data directly into very small antennas. Naval forces will no longer be restricted to working with large antennas, and even the smallest ships will be able to receive the kind of information formerly relegated to "big decks."[3]

Since GBS enables the storage, retrieval, and dissemination of huge information files, which otherwise would quickly exceed the capability of most Naval forces, tailoring the "push and pull" dissemination architecture for GBS presents a significant challenge. A user cannot request information directly through GBS. Instead, the user must request the needed information (user pull) using other, slower, communications means.[4]

GBS will deliver a variety of data. Weather imagery, commercial broadcasting, operational orders, and intelligence will share time and bandwidth on the system. Based on operational tests of concept, and service inputs, intelligence information will comprise a significant portion of the information carried. The challenge for intelligence planners will be providing useful, value-added content and in enough quantity to make efficient use of the GBS system. Meeting this challenge will require new ways to prepare and package intelligence products. GBS is designed to best function as an information "push" system, delivering scheduled data in much the same way as commercial broadcast

satellites such as PrimeStar. This system demands dedicated production and broadcast control efforts to make the best use of the bandwidth. Yet even as this system requires additional efforts, major intelligence centers must deal with reduced staffing. The number of personnel available for analysis and production is the choke point of the intelligence cycle--a situation certain to be made worse by the amount of effort required to manage and produce information for GBS.

Information management will be a theater issue. Theater Commander in Chiefs (CINCs) are responsible for GBS dissemination within their area of responsibility. The corresponding theater intelligence centers will be making decisions on how to use the GBS system to provide intelligence support to deployed forces. As GBS is designed as a "push" broadcast service, intelligence centers are expected to emphasize that aspect of dissemination in their plans for GBS use, even if they have few plans on how to support GBS push with programming.[5]

GBS will support user pull as well. Users can browse for information for themselves over GBS in a manner similar to using the commercial Dish Satellite system, which provides Internet access to consumers. The intelligence networks are already fairly well established to support this kind of classified browsing. By browsing for existing information through GBS, users will be making use of existing databases and intelligence "homepages" and not requiring special production for GBS. The high capacity of GBS will not be available to all units all of the time, switching from browsing over GBS to browsing over other channels should make little difference to intelligence producers--if they avoid spending excessive resources on GBS-only production.

II. BACKGROUND

There is an important distinction between information and intelligence. Information is an assimilation of data that has been gathered, but not fully correlated, analyzed, or interpreted. Intelligence, on the other hand, is the product resulting from the evaluation and interpretation of available information. Integration and analysis, combined with a thorough understanding of mission requirements, convert information into usable intelligence.[6]

Converting information into intelligence and making it available to users is a continuous process known as the intelligence cycle. There are six steps to doing this: planning and direction; collection, processing and exploitation; production; dissemination and integration; and evaluation.[7]

Intelligence dissemination, the last step in the intelligence cycle, is the conveyance of intelligence to users in a suitable form.[8] The goal of the dissemination process is to provide the right amount of appropriately classified intelligence when, where, and how it is needed.[9] The dissemination process should not overwhelm the tactical user with massive amounts of data. Instead, intelligence dissemination should follow established procedures designed to push time-sensitive, threat-warning data to the commander, while allowing him to pull less time-sensitive intelligence required for the mission.[10]

Challenges to Intelligence Dissemination

Intelligence managers face a dilemma with the dissemination of intelligence. While intelligence systems provide ever-increasing amounts of information, production centers find it more difficult to provide the operational commander with finished

intelligence.[11] Theater intelligence consumers during Operation Desert Storm, the U.S.-led war against Iraq, were for the most part unsatisfied with the dissemination of intelligence, particularly imagery products. Planners were forced to load critical intelligence (and the daily Air Tasking Order) onto navy planes and fly them to ships at sea. Several initiatives were started after the war to provide more timely intelligence, particularly digital imagery, mapping, and video products.[12]

As commanders become accustomed to using these modern digitized products, intelligence managers find they lack the communications bandwidth to carry these increasingly large files. Current military satellite communications (MILSATCOM) systems are oversubscribed. Naval requirements for MILSATCOM duplex communications are expected to exceed capabilities by the turn of the century.[13]

GBS Role in Intelligence Dissemination

Many of the initiatives to improve intelligence dissemination have focused on improving the speed of communications. The Global Broadcast Service (GBS) exemplifies the current end state of a long line of incremental improvements in communications technology (see figure II-1). GBS was designed to relieve the congestion of existing communications systems for mobile and deployed forces, which are quickly saturated during the early phases of any crises. GBS was also designed to allow the near-simultaneous transmission of huge but critical data files such as imagery, weather, and Air Tasking Orders (ATO). GBS will supply high-speed, one-way transmission of a large amount of data to units that are deployed. By doing this, existing and planned two-way communications systems will be able to better support lower volume communications needs of subordinate elements--GBS is not a replacement for

existing military SATCOM systems.[14]

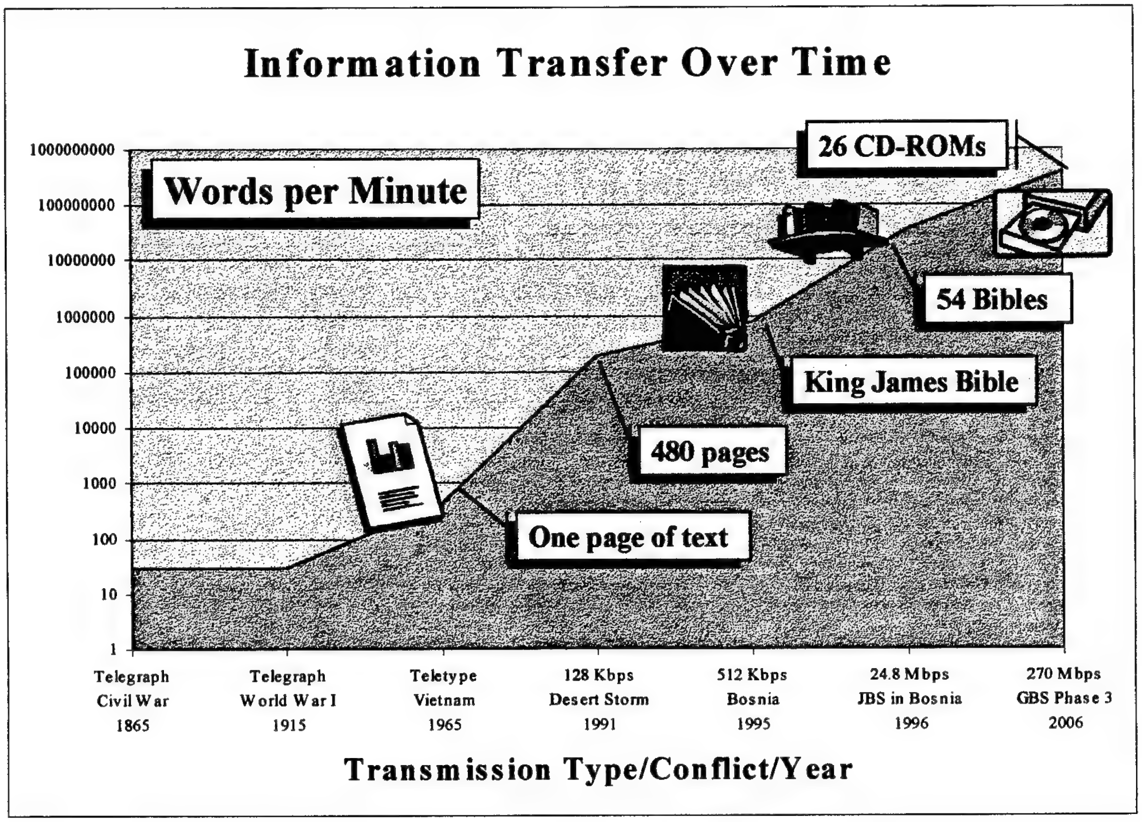


Figure II-1. Information Transfer Over Time.[15]

Conclusion

With the GBS system the intelligence manager has the means to rapidly disseminate large amounts of intelligence directly to deployed forces. GBS solves some problems with information dissemination identified during the Gulf War, making possible the near-simultaneous transfer of critical information to multiple users. While GBS may speed the flow of information, it does nothing to improve the quality of intelligence. Given the large capacity of GBS, intelligence managers may be under unreasonable pressures to release information to fill available bandwidth. The result could be more raw information for commanders, and less finished intelligence.

III. GBS: An Overview

The Global Broadcast Service promises to deliver data at significantly faster rates than current systems. However, the physical design of GBS has limitations that must be considered by naval forces before they decide how they will incorporate the system into their operations. GBS high-capacity bandwidth will not be available to every user all the time. Available GBS bandwidth will vary by location, some users will enjoy very high bandwidth from GBS, others will have less, and those outside coverage will have none. Orbital mechanics of the satellites that carry GBS will result in less than worldwide coverage, which has significance for naval operations.[16]

Physical Design

GBS is proposed to serve garrison and tactical users with a satellite-based broadcast capability. A one-way broadcast will provide relevant tactical and non-tactical products to the users. Broadcast signals would be transmitted to a large number of user receive units within the Commander in Chief's (CINCs) area of responsibility (AOR). This information flow, or multicast, allows simultaneous broadcast of a variety of data and video products to specified users. The system can provide these products to all users, a small subset of users, or in some cases, a single user depending on how the information is addressed. Providing a high data rate stream of video, data, imagery, and other information from high powered broadcast satellites to commanders, mobile forces, and various users has previously not been a capability that the military could provide within the existing architecture. GBS will provide continuous and simultaneous coverage from seventy degrees north latitude to seventy degrees south latitude in support of highly mobile, and often times disbursed warfighters. The CINCs will have authority over

apportioning GBS within their AOR.[17]

GBS will provide a high data rate transmission from a limited number of fixed and deployable injection terminals. The content will be managed by the broadcast segment in each satellite field of view. Ideally multiple sources will provide information content to the satellite broadcast manager at the direction of the CINCs. As with existing satellite capabilities, the CINCs theater information manager will establish priorities, authorize user access, coordinate broadcast schedules, and allocate resources. It is significant that the details of the daunting task of information management has yet to be worked out, as conflicts exist between the services and the CINCs over allocation of GBS resources.[18]

The GBS space segment consists of high-power satellite transponders that provide a high-speed, wideband, simplex broadcast signal. Dramatic advances in power and weight capabilities, as well as on-board processing enable the systems to reach high data rates to small, mobile tactical terminals.[19]

Limited IOC

GBS will be physically deployed in three phases. Through these phases the GBS project will transition from limited demonstration to payload packages hosted on Navy satellites, and finally as dedicated satellites with near continuous worldwide coverage (see figure III-1).

Phase I: 1996-2000

Phase I will last from fiscal years 1996 through July of 2000. It is intended as a limited demonstration of the systems capabilities. Leased commercial satellite services operating with limited coverage areas were used for concept development,

demonstrations, and limited operational support. In particular, operational support was provided to forces deployed to Bosnia. This test of support was termed the Joint Broadcast Service (JBS).[20]

DoD deployed the Joint Broadcast Service (JBS) to EUCOM in support of the US peacekeeping operations in Bosnia-Herzegovina. A principal effort for JBS was to provide PREDATOR Unmanned Aerial Vehicle (UAV) video to deployed commanders. Initial operations for JBS began in April 1996, eventually broadcasting high bandwidth information to 27 receive sites in the European Theater. Like GBS, JBS was designed with the operational components of a Joint Information Management Center (JIMC) in the Pentagon, a Theater Injection Site (TIS) at RAF Molesworth, UK, and a Broadcast Management Center (BMC) collocated with the JIMC.[21]

Phase II: 2000-2008

Phase II of the GBS deployment is scheduled for July 2000 through 2008. In phase II GBS payload packages will be hosted on Navy satellites UFO eight, nine, and ten. The system will have two distinct satellite broadcast patterns that can provide coverage to specific areas. Each satellite will have two steerable 500 nautical mile (nm) spot beams, and one steerable 2000 nm spot beam. The 2,000-nm spot beam is capable of supporting a data rate of one point five Mbps. Each of the two 500 nm spot beams will support data rates of up to twenty-four Mbps per transponder. The spot beam locations and orbital positions will limit coverage areas. The continued lease of commercial satellite services may be used to augment UFO GBS where coverage gaps exist in the continental United States (see figures III-2 and III-3).[22]

Phase III: 2008+

Phase III deployment will not occur until after 2008. In phase three GBS will achieve the objective on-orbit capability and provide robust capability. It will provide worldwide broadcast coverage with near continuous or time critical information to broadly dispersed users.[23] As phase III not been funded, final operational status is uncertain. Therefore for all practical purposes GBS Phase II is a long-term solution.[24]

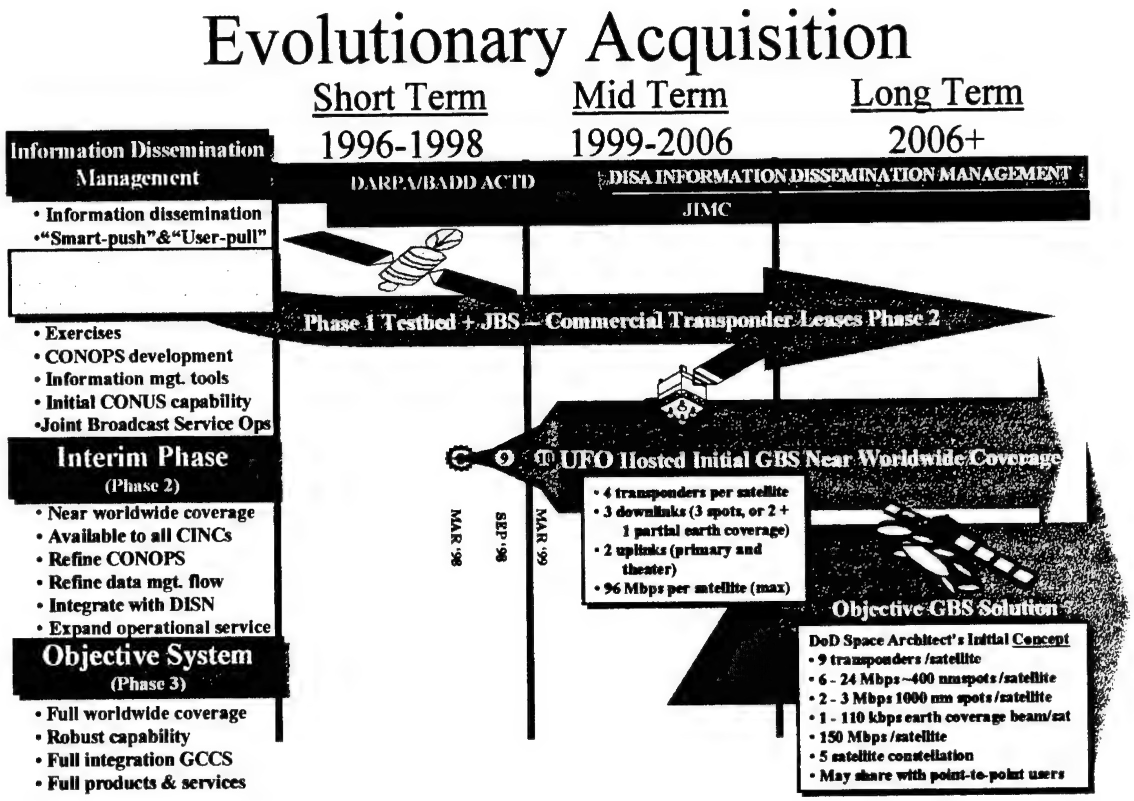


Figure III-1. The Evolution of GBS.[25]

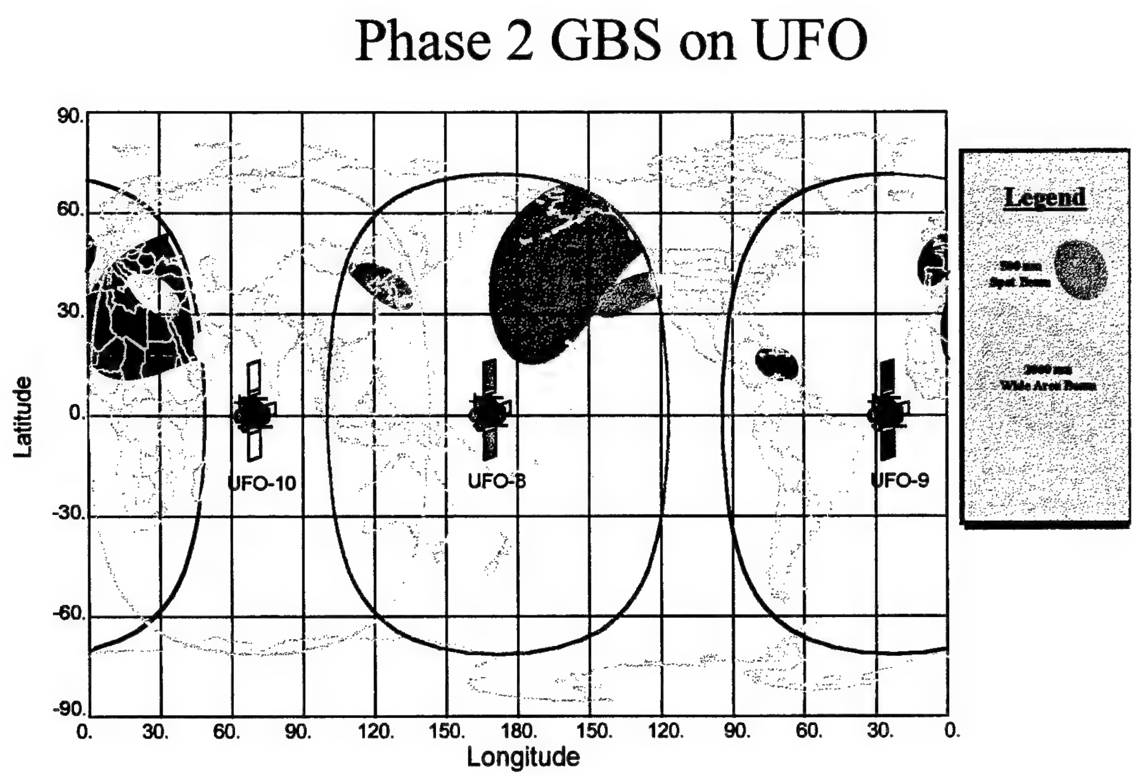


Figure III-2. Phase 2 GBS Ground Trace.[26]

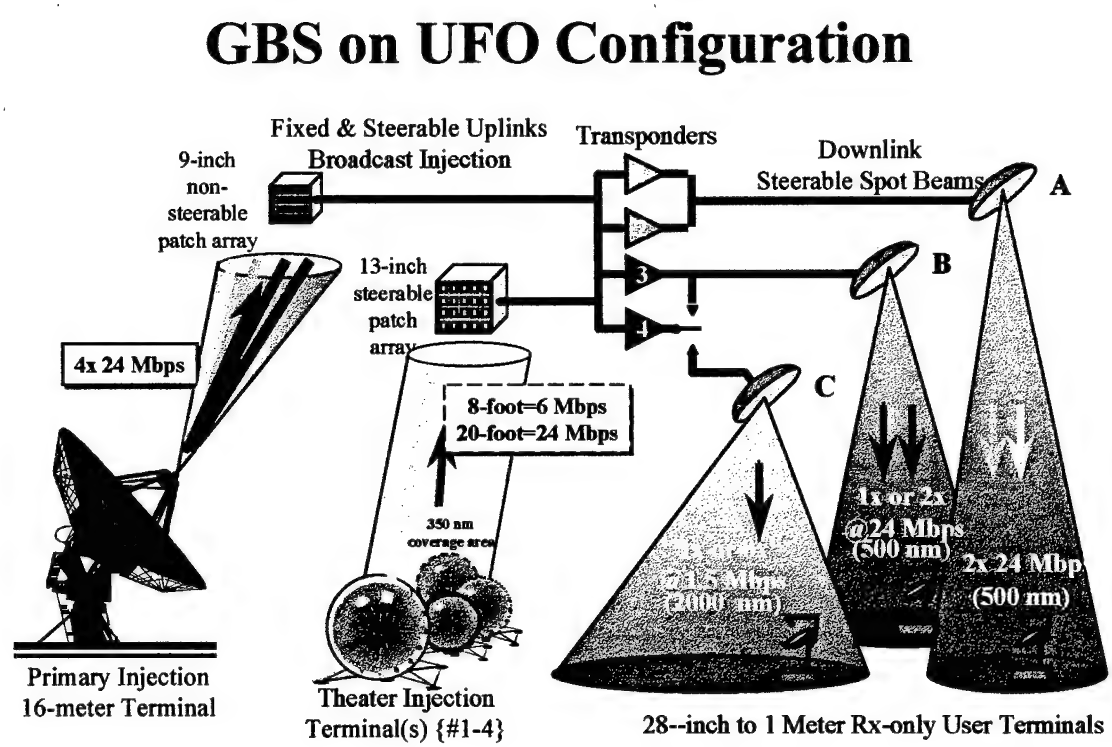


Figure III-3. Phase 2 GBS Configuration.[27]

Limitations to Information Access

Since GBS does have limitations and is managed jointly, it should not be a surprise that conflicts exist over allocation of its resources. The CINCs are not likely to be satisfied with the existing arrangement. Seven CINCs will share three GBS spot beams during phase II. Should two crises occur simultaneously in two theaters, GBS will not be able to support both equally. Even if two crises occur simultaneously in the same theater, GBS will not be able to support forces deployed equally.[28]

The services have conflicts over allocation of GBS resources as well. These differences center on the types of operations that are conducted by the services. The Army would like theater Commanders to focus GBS spot beams on a particular location, presumably the ground force commander. Not surprisingly, the Navy would like to see the GBS spot beam shifted periodically to service other customers, presumably naval forces at sea, in a process termed dynamic allocation. Clearly whatever the plan that evolves, some users will miss out on the GBS signal at least part of the time.[29]

Since the GBS design carries inherent limits to use and information flow. How the system is managed will effect how much information naval forces can derive from the system. Access to GBS can effect operations, since decisions may be predicated on information that is to come over GBS.

The GBS broadcast will not be a constant for any group of users, with possibly one exception. Naval planners must anticipate five different levels of GBS access. The best situation would be for those forces that would be within the shadow of a narrow, 200nm spot beam continuously focused on their area. Those forces will be receiving continuous GBS data at the maximum rate, about 24 Mbps. The U.S. Army has proposed

that GBS be utilized in this manner, presumably focusing the narrow beam on the area of the Joint Force Land Component Commander. Next would be forces that would enjoy a narrow 200 nm spot beam, but only some of the time. The Navy has proposed GBS be operated in this manner. Dubbing the technique "distributed operations", the Navy believes by shifting the narrow beam from area to area, the greater number of forces can be served. Next would be forces within the wider 2000 nm spot beam. They would enjoy GBS data at the significantly slower rate of 1.5 Mbps. Naval forces that are transiting to a crisis area might pass through one of the wider spot beams as they cross an ocean. They would benefit from GBS data at the 1.5 Mbps rate, but only temporarily. Some forces might have no access to GBS data during a crisis. Forces operating or transiting from the Indian Ocean to the Pacific during a Korean crisis, for example, would be outside coverage areas. Those forces would have no GBS coverage unless one of the spot beams was deliberately steered to their location, which would not be likely during a crisis. Finally, continental United States-based forces may enjoy full-time access to GBS data, should the program office complete plans to supplement GBS coverage with commercial satellites over the U.S. (see figure III-4).[30]

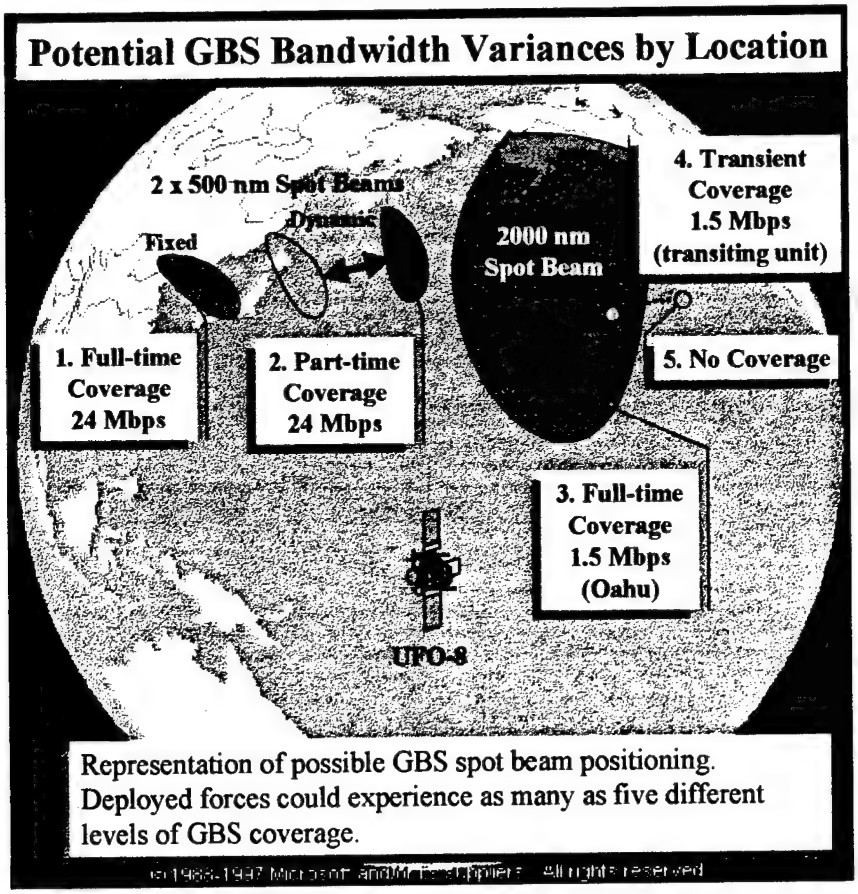


Figure III-4. GBS Bandwidth Will Vary by Location.[31]

Types of Data Products

There will be two primary types of products for GBS: video and data. Each requires different handling procedures. The relationship of type of product desired to availability of the GBS broadcast signal will be significant to operational planners.[32] Deployed forces that need large products such as images or the daily time-phased force deployment data (TPFDD) will find hours added to the transmit time if they are outside GBS signal coverage.

Video and stream products may originate from the CINC, Service Component, or be Agency-unique and will be available to all GBS-equipped units in the broadcast footprint. By its nature, video requires continuous bandwidth for an extended period of

time, generally 10 to 30 minutes or more, and up to 24 hours a day in some cases. Examples of video products include daily intelligence briefings, distance learning/training, Armed Forces Radio and Television Service (AFRTS), commercial broadcasts, and other services such as unmanned aerial vehicle video dissemination.[33]

Data products vary widely in file size and content. The primary reason to use GBS to disseminate data products is its ability to distribute a product simultaneously across a wide area, and its speed. The high data rate flow of GBS can allow for multiple transmissions of the same products allowing assurance of delivery of high value products. Some products requiring such assurance would be the air tasking order (ATO), ballistic missile warning, and the Tomahawk Mission Data Update (MDU).[34]

The design limitations of GBS, and how it will be employed, are significant to the Navy. Knowing they will be positioned within continuous GBS coverage during a crisis, for example, the Navy might plan on receiving video feeds from unmanned aerial vehicles, or last-minute target changes for the Tomahawk missile. Knowing they may not have continuous GBS coverage, on the other hand, would call for different plans and apportionment of communications resources.[35]

Expense Limits Fielding

One last aspect of GBS hardware effects intelligence dissemination. Although the concept of GBS was intended to provide satellite broadcast to low-level units, receive suites are relatively expensive and costs will limit its fielding. The most economical system was expected to cost at least eighty-three to one hundred thousand dollars. More recent cost estimates adjusted prices higher. Due to fiscal constraints the Marine Corps and the Navy have reduce their purchases of the system, although the Navy maintains a

significant commitment to implementing the system.[36]

Conclusion

The physical design of GBS provides for many constraints and limitations to its employment. Not all users in a theater will have access to high-capacity bandwidth at the same time. Bandwidth will vary as determined by the locations of the steerable spot beams. Some theaters will have to share bandwidth, and all theaters will be unable to support multiple crises simultaneously with the system. The availability or non-availability of the GBS signal will have operational implications for naval forces. And all these physical factors have an effect on the way intelligence will be disseminated to the Navy over GBS.

IV. Intelligence Dissemination and GBS

The availability of GBS has several implications for the delivery of intelligence information. If it were the delivery of large amount of data alone, physical limitations to the system show that considerations must be made for when the system is not available. But intelligence dissemination is more than just delivering data. The goal of intelligence dissemination is to deliver the right amount of information when, where, and in the form needed. The information provided must meet standards for usefulness. To be effective, naval intelligence must share several, sometimes conflicting, attributes. Intelligence should be timely enough to support decision-making. It should be reported objectively, without the influence of bias. To be usable, intelligence should be easy to understand and apply to operational decisions, in relevant and proper formats. To support the commander's planning and operations, intelligence should be available when and where needed. It should be thorough enough to encompass the information needed. Intelligence should be accurate and relevant to the operations at hand and the level or command for which it is intended.[37]

Operational intelligence includes all levels of collection ranging from national system (such as satellites) to tactical reconnaissance assets (such as unmanned aerial vehicles). The process of fusing raw intelligence information collected from these various sensors into a finished intelligence product is part of a larger process known as the intelligence cycle. The intelligence cycle consists of planning and direction, collecting, processing, production, and dissemination. Operational commanders determine intelligence requirements and data is collected based on assigned collection priorities. Once data is collected, the information is processed by converting the data into

a suitable format for analysis. During production, the processed information is evaluated and integrated with data collected from other sources. Finished intelligence is disseminated to the operational commander through a variety of media.[38]

Figure IV-1. The Intelligence Cycle.[39]

Impact of Technology

Technology has made a significant impact on intelligence collection and dissemination. Collection capacity has been improved through the use of advanced sensor technology. The use of RADAR, infrared, and multispectral imagery complement optical imagery. Manned reconnaissance aircraft collect a variety of information to include electronic intelligence (ELINT), communications intelligence (COMINT), acoustic intelligence (ACINT), imagery intelligence (IMINT), and measurements and signature intelligence (MASINT). Unmanned aerial vehicles offer real-time video and other sensor technology.[40]

Intelligence planners today have an unprecedented degree of access to intelligence information. Secure networks of multi-media information systems link national intelligence agencies with operational and tactical users. The architecture functions like a

classified World Wide Web, populated with intelligence "homepages" and databases. The user now has the ability to query intelligence nodes according to operational requirements, "pulling" tailored information from an extensive network of sources.[41]

Unintended Consequences

There are several potential unintended negative consequences of intelligence dissemination over GBS that must be considered. Joint Vision 2010 drives the quest for information dominance, but if the glut of data that will flow into command posts from GBS broadcasts cannot be filtered into secure, reliable, manageable, and just-in-time knowledge for the warfighter, the vision will be shattered.[42]

Information overload occurs when the volume of data provided by the intelligence systems overwhelms the user, making it impossible to distinguish critical intelligence from extraneous data. Efforts to incorporate legacy databases, previously undigitized or uncataloged professional papers, and open source information will result in larger and larger amounts of available information.[43]

In a system designed to support push broadcasting, the tendency may be to seek to fill up available bandwidth with information--worthwhile or not. During the Bosnia test of the Joint Broadcast Service, for example, JBS exceeded the production capacity of the various information producers. In some cases, USEUCOM J6 staff searched for products to fill JBS broadcast time. When first presented, live video from the Predator unmanned aerial vehicle (UAV) was a popular way to fill JBS airtime. However the novelty of the programming soon wore off as users grew tired of watching daily live UAV video of the tops of clouds.[44]

Sophisticated computer programs can be used to cope with the massive data loads

in an attempt to present to the analyst a display of relevant information. However, the more complex the presentation scheme, the more likely it is that vital intelligence will be obscured by superfluous information, another possible unintended consequence of using GBS data.[45]

High-speed collection systems, such as Predator UAV, coupled with the dissemination capabilities provided by GBS, may cause users to expect the arrival of new intelligence to clarify an ambiguous situation. Battlefield commanders may come to expect near perfect intelligence. [46] Sometimes, however, it will be dark or cloud covered, with only low-resolution imagery available. A Scud missile launcher and a school bus can look the same under those conditions.[47] The result of using immediate, but ambiguous intelligence could be disastrous.

Users now have the ability to range for information from sources far outside an organization's command structure. The joint intelligence architecture, especially as expressed on the Internet-like Intelink, results in a mixture of vertical and horizontal flows of information. Analysts can receive inputs from multiple sources, a situation that can confuse and distract decision-makers. This situation could be exacerbated if users are able to browse freely for information over high-capacity GBS links.[48]

As technology improves, systems engineers seek to reduce human intervention for the sake of efficiency. Advances in technology allow the commander some measure of situational awareness through the processing of volumes of raw data independent of analysis. High-speed communications systems provide all the information a commander needs to support the decision process. In such a situation, it becomes difficult to provide additional insight from human analysis. Analysis is time consuming, providing a

bottleneck to slow information that some have argued should go directly from "sensor-to-shooter." New technology focuses on automated processing at the expense of human analysis. The availability of GBS bandwidth waiting to be filled may pressure intelligence producers to release more raw information and use less analysis.[49]

Conclusion

GBS will significantly impact intelligence dissemination to operational forces. GBS will allow the lowest-level tactical units to receive intelligence support previously reserved for large combat forces such as Navy Carrier Battle Groups and Army Divisions. GBS will also allow those low-level forces access to amounts of information vastly greater than previously possible. The tendency will be to swamp users with GBS data, potentially resulting in several unintended consequences of increased data access. Low-level users can be passive recipients of well-intentioned "smart-push" products, or they can try to avoid an overflow of insignificant information by actively managing the flow of intelligence information that they receive.[50]

V. The Navy and GBS

The Navy depends in a critical way upon satellite communications. The highly mobile and dispersed employment of naval power in joint and coalition warfare dictates SATCOM connectivity. The nature of naval operations makes them ideal users of the GBS system. Operating in remote areas far from normal communications support, satellite communications systems can bring critical information from shore-based experts to the afloat commanders. Naval commanders have become dependent on satellite communications to provide up to date orders and information critical to decision-making.[51]

Recognizing the benefits possible through the GBS system, the Navy has made a significant commitment to incorporation of Global Broadcast Service technology. Receive terminals will be fielded to a wide variety of ships, and nearly all naval combatants by 2004. As naval forces are dependent on satellite communications and support from ashore facilities, and GBS should meet a lot of their needs. By committing to the use of GBS however, the Navy is compelled to use a joint information dissemination architecture designed for that system. If the Navy becomes reliant on GBS for information, they will be obliged to work within the existing dissemination plan to access the system.[52]

Maritime Forces Need Focused Intelligence

Naval forces are expected to respond to a variety of crises with little or no advanced warning. The majority of the world's population lives close to the sea, and within the sphere of influence of maritime operation. On a typical deployment a Navy Carrier Battle Group or Marine Amphibious Ready Group must be ready to respond to a

crisis in any country they can reasonable expect to reach.

In order to be able to respond to emerging crises, the intelligence staffs supporting naval forces must be able to count on the expertise, information, and on-demand support from national agencies. The problem is that naval forces deploy at sea, and the experts they need usually are not. Limited intelligence staffs rely on secure communications paths back to theater intelligence centers. As communications capabilities have increased, naval forces expect even more support from ashore facilities.[53]

Forces preparing for time-sensitive contingency operations need to be able to receive national and theater level intelligence products tailored specifically for their contingency and organization. Because of the time factor in planning, volumes of data may not be merely dumped on the unit. Deploying forces need timely, relevant, and readily useable information. As they must be able to respond to crises in any number of countries, forces deployed at sea need contextual information to give meaning to the intelligence and operational traffic they receive. Physically isolated and deployed for months at a time, maritime forces lack the broader situational awareness necessary to place intelligence and operational information in context.[54]

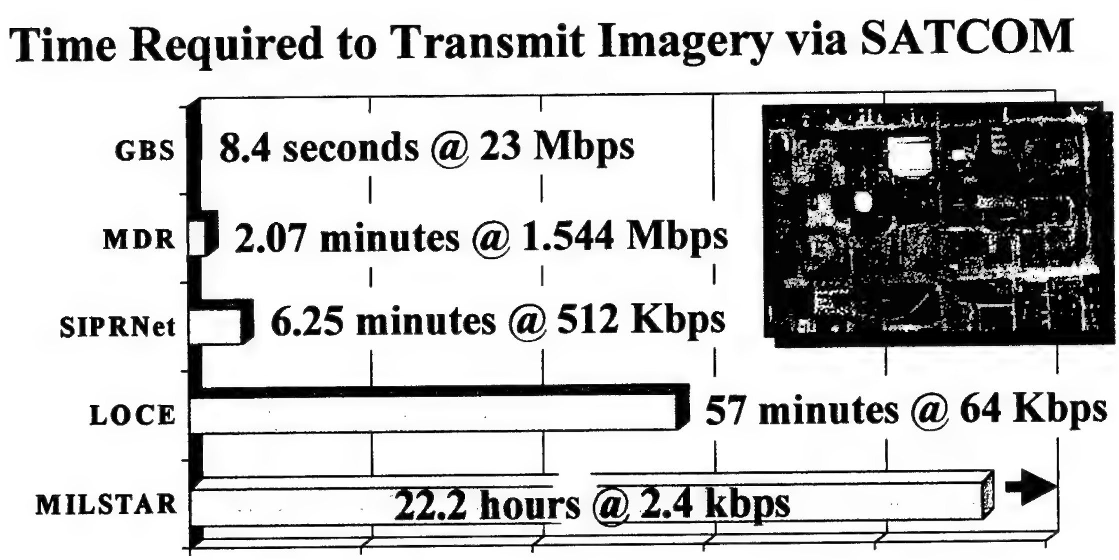
Providing the maritime commander with information for decision making is a complex task. It can be a time critical and sensitive matter to give the commander the right information at the right time. It is not enough to provide the decision-maker with a great deal of data. The content must be filtered to provide meaningful and timely information. Giving the commander too much information or untimely information can result in bad, or sometimes deadly, situations.[55]

GBS and Maritime Forces

The Global Broadcast Service will help naval forces several ways. GBS will greatly increase the speed at which information can be transferred. It will allow coordinated last-minute target updates to multiple Navy cruise missiles, or distribute data of all types from unmanned aerial vehicles (or satellites) to ships cruising off hostile territory. Current Navy SATCOM bandwidth capabilities are barely adequate for such operations.[56]

For example, using existing UHF SATCOM channels, it has taken as long as nineteen hours to pass a Tomahawk Mission Data Update (MDU) to a submarine. This unacceptable rate of delivery threatens the Navy's role in Tomahawk missile strikes. With GBS targeting information can be delivered in minutes (see figure V-1).[57] Additionally, due to the geographics of their operations, naval combatants underway in remote ocean areas may have more GBS bandwidth than any other kind of subscriber (see figure III-4).

Recognizing the value of the GBS system, the Navy plans to install GBS terminals in every ship and submarine class, including not only combatants, but auxiliary ships, selected reserve fleet ships, and some patrol craft. 90% of naval combatants will have GBS receive capability by 2004 (see table V-1).[58]



Time required to receive 8x10 annotated image, 24 Mb file over representative military SATCOM systems. (USGS photo)

Figure V-1. Imagery Transfer Time over Satellite Communications Channels.[59]

Table V-1. Navy GBS Terminal Fielding Plan.[60]

COMPONENT	DEPLOYMENT	TIME PERIOD
PAC	CARL VINSON BATTLE GROUP (9 OF 11 SHIPS)	5/98
FLEET FLAGS	USS CORONADO & USS BLUE RIDGE	5/98
COMMAND	USS KITTY HAWK & USS BELLEAU WOOD	5/98
LANT	ENTERPRISE BATTLE GROUP(11 OF 13 SHIPS)	5/98
LANT	T. ROOSEVELT BATTLE GROUP (11 OF 13 SHIPS)	10/98
MEF	(5 SHIPS)	FY99
FLEET FLAGS	USS MOUNT WHITNEY & USS LA SALLE	FY99
PAC	CONSTELLATION BATTLE GROUP (11 OF 13 SHIPS)	1/99
LANT	G. WASHINGTON BATTLE GROUP (11 SHIPS)	1/99
PAC	J.C. STENNIS BATTLE GROUP (10 OF 12 SHIPS)	7/99
LANT	D.D. EISENHOWER BATTLE GROUP (11 OF 13 SHIPS)	8/99
MEF	(3 SHIPS)	FY99
PAC	A. LINCOLN BATTLE GROUP (8 OF 11 SHIPS)	3/00
MEF	(6 SHIPS)	FY00
OTHERS	(54 SHIPS AND 4 SUBMARINES)	FY00
OTHERS	(63 SHIPS AND 3 SUBMARINES	FY01
OTHERS	(40 SHIPS AND 11 SUBMARINES)	FY02
OTHERS	(24 SHIPS AND 8 SUBMARINES)	FY03

Conclusion

The Navy is making a significant commitment to GBS technology, installing systems throughout the fleet. That commitment implies acceptance of the physical limitations of the system, and the logical dissemination architecture that will be decided on by the CINCs. Logically, the Navy has a vested interest in how they will receive information over the system.

VI. GBS DISSEMINATION ARCHITECTURE

The intelligence dissemination logical architecture for GBS will effect the way forces receive intelligence. Management of the information flow has been delegated to the theater CINCs who must decide how they will control information flow over the system. Information dissemination management architectures have been proposed to assist the CINCs in using GBS. "Little IDM" is the unofficial name for the Joint Staff's plan for information dissemination management over GBS, as contrasted with the overarching scheme for dissemination management DoD-wide, called "Big IDM."

There are three ways for users to receive information over GBS. Producers can broadcast push information to customers on a schedule, producers can retrieve information and send it to customers by special request, and finally, users can browse interactively and pull the information they need when they want it. This final method requires a GBS connection to SIPRNet. While that configuration will be physically possible by June of 2000, the proposed dissemination architecture for the system addresses only dedicated production for GBS. Navy systems planners are concerned with an apparent excessive emphasis dissemination managers have on constraining GBS though layered scrutiny and enforcement of CINC Theater Information Management processes. They see GBS as being micro-managed unlike any other SATCOM or terrestrial communications capability--at the individual product and individual user level.[61]

"Little IDM"

The Joint Staff recognizes that CINCs need to be responsive to users and tailor GBS broadcasts to meet their needs. They provided this capability by giving the CINCs

control over apportioned resources within their AOR. The broadcast management segment will perform a variety of functions in managing the broadcast based on the CINCs priorities. This segment has the undefined task of accepting, coordinating, and packaging information from several sources. The goal for the Broadcast Management Center (BMC) is to ensure GBS is used in an efficient manner. The BMC will work closely with the Theater Information Managers (TIM) in coordinating the broadcast to satisfy user requests. The TIMs will have primary operational control over what, when, and to whom information is disseminated in a particular AOR.[62]

The BMC provides source authentication, directory services, downlink management scheduling, and assembles user profiles. These user profiles determine the types of information that a unit will be interested in, and will be used to predict what type of data a user needs and how often they need it. This intelligent profiling is referred to as smart push.[63] CINCs can accommodate "user pull" as well. To accomplish this users will request information through existing information retrieval paths. Requested information will then be provided through existing information source paths to users, or using GBS when appropriate.[64]

To complement the Broadcast Management Centers physical role in GBS dissemination, the Theater Information Manager was given a logical role in controlling functions and responsibilities needed for each CINC to manage and control their apportionment of the GBS broadcast. The Theater Information Managers role is to establish CINC policies and procedures governing information flow. The TIM directs GBS operations, coordinates broadcast schedules, manages resources, identifies new products, reviews and validates user profiles, and audits user pulls (see figure VI-1).[65]

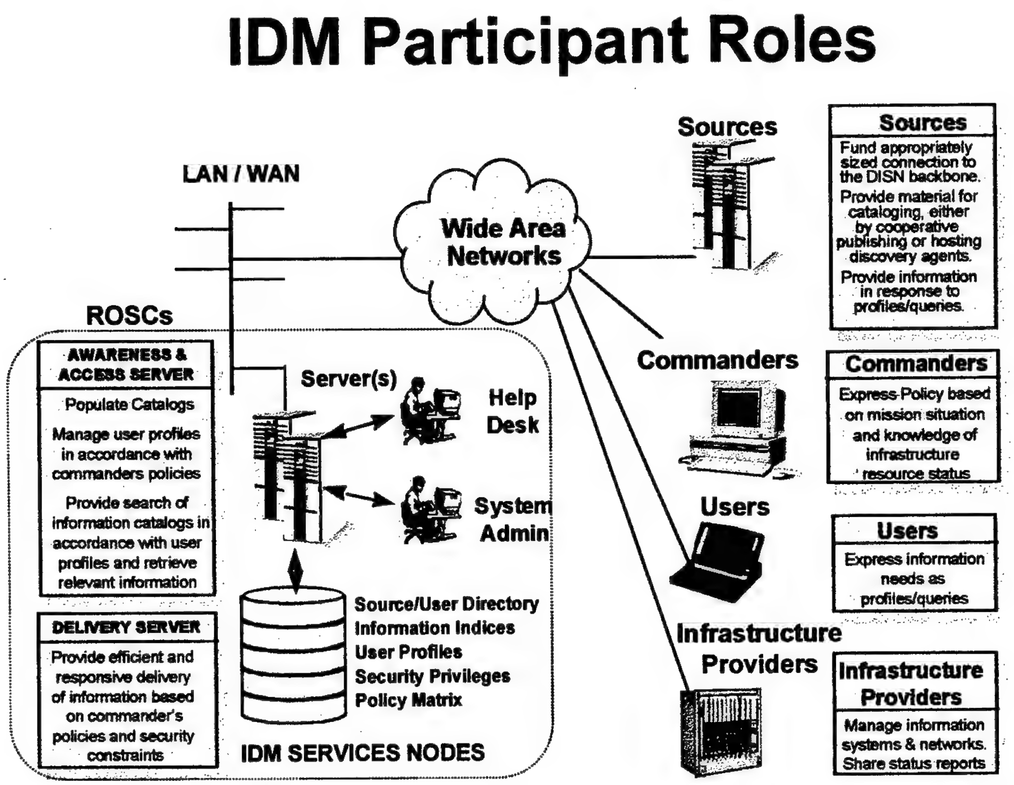


Figure VI-1. Information Dissemination Management Participant Roles.[66]

The Beginnings of Push

Automating the delivery of intelligence is not difficult. Intelink for example is a very capable mechanism to transmit intelligence electronically. Intelink is interactive in nature, users search for information of interest, selecting data of interest. Information managers wondered if a system could be designed that would "know" a users interests, and deliver information automatically.[67]

Responding to a similar need in the civilian community, several companies announced products in 1997 to automatically deliver content to users of the Internet. Known as "push technology," these products provided users with the capability to select, and then automatically receive, various types of information direct to their computers. The information could be filtered to match user interests through the use of a "profile."

Early "push" products delivered news, weather, stock quotes, and not a few advertisements. [68]

Push technology was a significantly different way to use the Internet. Before, using what was known as "pull" technology, users searched out and retrieved the information that they desired. Push delivery was very different in that new information appeared automatically. It was designed to automate data delivery, and when push technology was first introduced, it quickly became the latest rage on the global Internet.[69]

Executives from the push software company PointCast approached the Defense Intelligence Agency's (DIA) Jim Peak in 1997 to explore the use of PointCast to deliver intelligence content over Intelink. The idea was to use the PointCast content distribution model to deliver intelligence information automatically. Project Spitfire was created to develop the pilot.[70]

Unfortunately, Project Spitfire had to be cancelled. Software for Intelink must work in both the Microsoft Windows, and Unix environments, and PointCast could not support Unix. More significant was the reservations many users were having about the use of push technology to deliver intelligence information. Several expressed similarities between push technology and "Spam", the colloquial term for unsolicited e-mail. So while selected automated delivery of intelligence may be a dream of the Intelligence Community, push technology remains undeveloped over Intelink.[71]

Smart Push/User Pull

The Navy plans to rely heavily on Network Centric principals for both GBS Push and Pull. But Navy planners are concerned that while the GBS capability being fielded will do an adequate job of smart push in a scheduled environment, it will fall very short

of aspirations in the area of user pull. The GBS dissemination architecture has a track record of slow responses to ad hoc user requests.[72]

In crisis situations, higher-level intelligence organizations need to anticipate user needs. Supporting organizations should understand the needs of subordinate units and "push" to them information they need without waiting for requests.[73] GBS dissemination architecture accommodates some of these crisis needs of lower-level forces. Under the smart-push concepts of IDM, higher-level staffs build GBS user profiles that feed needed information to deployed forces.[74] Product is delivered from a subscriber catalog automatically on a schedule, and updated automatically. Selected preprogrammed stream data can also be organized into channels available for a selected period of time. Channels are a particular way to push information to users. CDA technology will allow the subscription and delivery of web-based content on a schedule. This is similar the civilian PointCast network once popular on the Internet.[75]

Using profiling tools to disseminate information has several advantages for the TIMs. The awareness and access tools of profilers reduce the labor needed to "market" information. Awareness tools, by making efficient catalogs, serve to reduce the need for good "browsing skills".[76]

Smart push is an efficient way to send information over GBS that is known and anticipated, such as a daily weather report. Aggregate delivery functions such as multicasting allow GBS to make more efficient use of resources and improve performance. However, aggregate delivery works best where all users desire the same content.[77]

The temptation will be to provide more and more information through smart push,

filling available bandwidth. Users need useful information, however, not more raw data. The challenge is to disseminate information, not data, according to Paul Muench, science advisor the telecommunications, National Imagery and Mapping Agency (NIMA). Proper exploitation, he suggests, allows the fire hose of collection to be coupled to the garden hose feeding the user. The user will make exaggerated and undisciplined demands and they should be satisfied with useful information, not a flood of raw data.[78]

As opposed to smart push, user pull differs in who requests the information. Under smart push user profiles were build for them by higher echelon staffs. With smart pull, the user either builds, or modifies their profile themselves, or makes ad hoc requests for information as needed.[79] By either method, these requests are transmitted to the TIM. The TIM takes the information requested and builds it into the broadcast. The process is not automated.[80]

A broadcast will not satisfy all users, and the IDM leadership acknowledges that user pull is a slow way to send information by request. When an organization is required to make formal requests to receive information, they must set aside time and personnel to prepare, transmit, and track these requests. During time-critical operations, these requests clog an already burdened communications system--even if there is sufficient bandwidth for the messages, analysts on both ends must take the time to edit, transmit, and manage these requests.[81]

If the broadcast lacks the information required, and if the user requests are not being serviced fast enough, deployed forces have one more option available to them. They can browse for information themselves over Intelink-S.

Interactive Browsing

Browsing over Intelink-S is a popular method of gathering information for intelligence planners. There will be some web browsing capability over GBS, if theater managers dedicate a channel to SIPRNet. However, the ability to use GBS to browse Intelink-S will not be supported until July 2000, and the CINCs must decide if they will support this capability.[82]

Allowing users to browse for information over GBS has several advantages. Organizations conducting pulls need not manage the requests, and low-level analysts will do more free research knowing they do not have to make formal requests through their chain of command. Most users are familiar with the process, through the civilian Internet and the classified Intelink-S. Major intelligence centers facilitate the process by building crisis homepages that conveniently group the latest intelligence of interest (see figure VI-2).

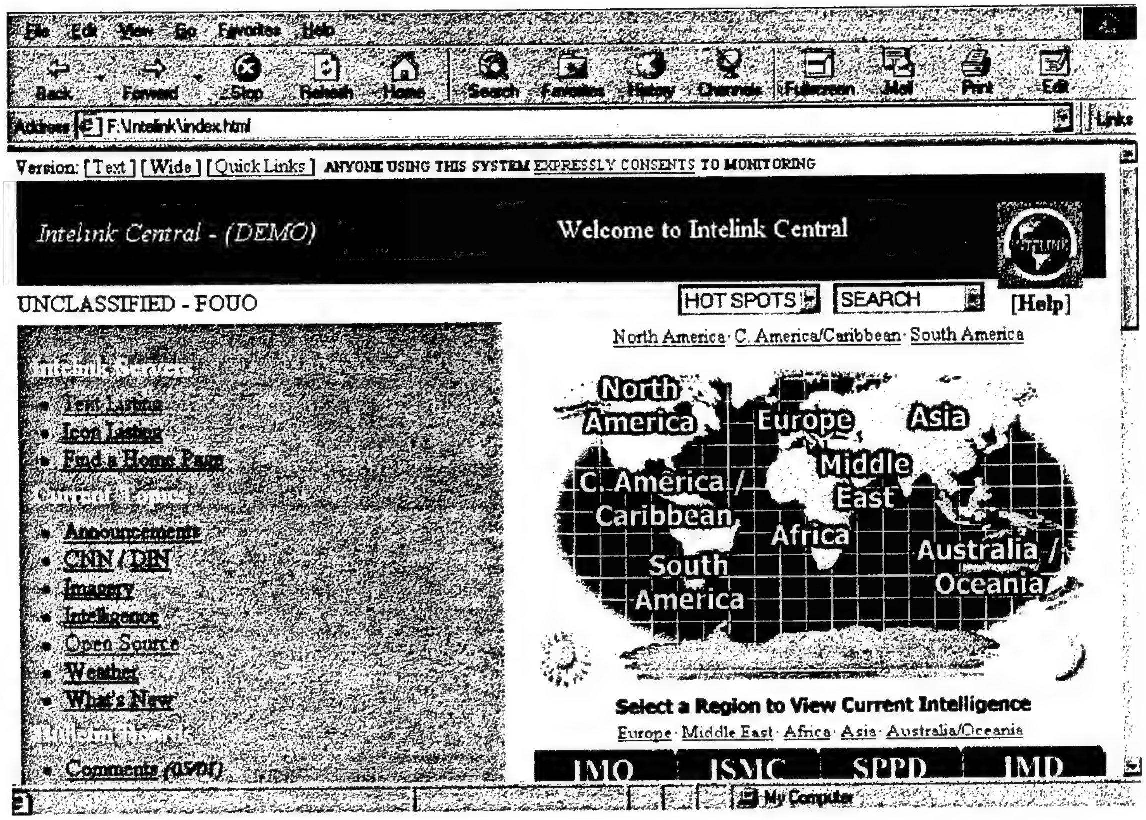


Figure VI-2. Intelink Central Homepage.[83]

There are disadvantages to using browsing over GBS. Given the large amount of bandwidth GBS offers, browsing is a slow and inefficient way to retrieve information. The effort of browsing can be labor-intensive, with success dependent on the search skills of the user. Additionally, browsing is an unmanaged process, if many users browse GBS at the same time, the bandwidth demands could slow the retrieval process for all.[84]

If users are to browse for significant amount of information using GBS and Intelink-S, consideration should be made for different levels of available bandwidth. Since various customers will experience a range of GBS broadcast bandwidth (see figure III-4), it makes sense to offer a range of products that are scaleable to the bandwidth available--whatever the source. An example could be in the handling of intelligence imagery. Users with the lowest available bandwidth, outside of any GBS spot beams,

might only want immediate reports from imagery. An example would be a call-out of the threat and location provided by an imagery analyst and transmitted via traditional message traffic means. The report would only be a few lines in length. Users with more available bandwidth, but still outside GBS coverage, might be able to receive a more detailed text message, which would include a more descriptive report from the imagery analyst, without overloading their communications systems. Next might be a page with an array of thumbnail-sized images of a target area. The bandwidth-challenged user would select only those images they wanted. Users with access to more bandwidth might select a set of annotated images, formatted with circles and arrows and comments provided by an analyst. At the highest end, the intelligence center would provide the user the ability to select and retrieve a full frame image at high resolution. Only users within a GBS spot beam might try accessing such a large file. In this way a scalable range of products can be offered that allows the user to choose the best product given the available bandwidth, and perhaps only the smallest of these products would be automatically pushed to the user.[85]

Theater Intelligence Centers and GBS

Theater CINCs, through their Joint Intelligence Centers (JICs), will control the dissemination process for GBS. There are no specific plans for how they will do that, although draft concepts of operations for GBS are being circulated within all the CINCs. CINCPAC received the first GBS equipment, and has the most robust architecture in place for its use. Despite the lack of formal GBS plans, the way that theater JICs have set up their existing intelligence dissemination architecture has an impact on how well they can embrace GBS.

Joint Intelligence Centers are the prime mover for intelligence support within a given theater of operations. They store and disseminate all-source intelligence collected by strategic, operational, and tactical sources. JICs also serve as the focal point for intelligence support requirements within their theaters. JIC databases are augmented by national level agency databases such as the National Security Agency (NSA), and Defense Intelligence Agency (DIA), the Central Intelligence Agency (CIA), and the National Imagery and Mapping Agency (NIMA).[86]

Joint Intelligence Center Pacific

The Joint Intelligence Center Pacific (JICPAC), in Honolulu Hawaii is the Theater Intelligence Center for USPACOM. When operational forces are conducting crisis planning, JICPAC works to reduce the time it takes for those commands to get the information they need. JICPAC realized that if they do not provide needed information, subordinate units would prepare it themselves by pulling the information they need over Intelink-S at lower bandwidths. JICPAC therefore seeks to reduce duplication of effort and inefficiency by providing tailored support at their level.[87]

JICPAC makes heavy use of web-based protocols. The intelligence centers overall goals are to make information easy to find, in a format that is easily understood and assimilated, and to have all necessary information in one location. JICPAC determined that by using a standard web interface, using the Standard Generalized Mark-up Language (SGML) protocols supported by current web browsers, eliminates the need for special programs and knowledge to access unique databases. By placing as much relevant information as possible at their center, JICPAC hopes to preclude unnecessary and time-consuming web surfing by planning staffs. JICPAC intends to do this by

reviewing information that planners and operators routinely ask for and including it in a package linked from one of JICPACs forty-three country homepages. They also link to information from other production centers that are posted to Intelink-S. Where information is located on the unclassified Intelink-U or OSIS nodes, JIPCAC will cache the information up to JICPACs own Intelink-S servers.[88]

The architecture already in place at JICPAC serves Intelink-S users well, allowing access to a wide variety of country-specific information. This architecture is very supportive of user browsing. However, GBS users will only have access to a portion of what is available at JICPAC. The transmit suite for CINCPACs deployment of GBS uses web-based protocols to receive requests and processing. Likewise, the fielded receive terminals re-disseminate information to end users using web-based protocols. However, information sources for GBS available through CINCPAC will consist of a limited subset of what are primarily their web-based sources loaded on SIPRNet. Dissemination will be by smart-push, users will select channels through profiling and must filter data they do not want (see figures VI-1, 2, and 3).[89]

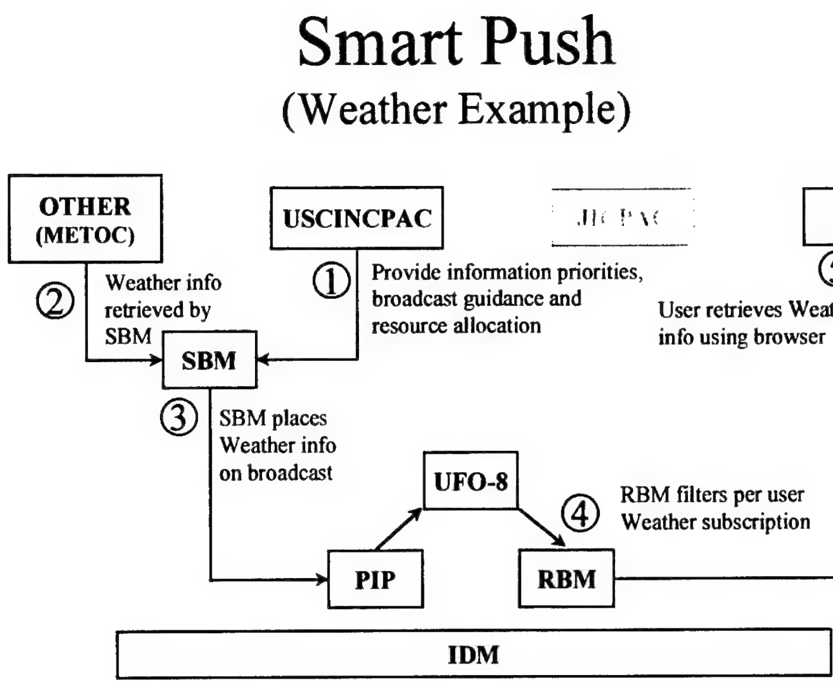


Figure VI-1. JICPAC Smart Push Concept.[90]

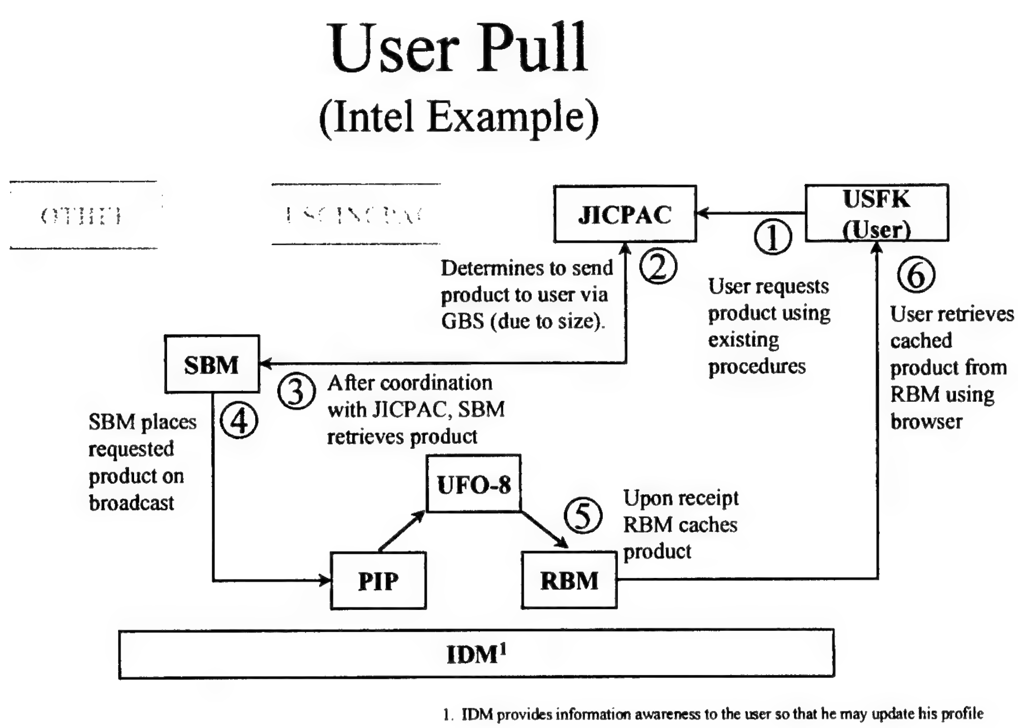


Figure VI-2. JICPAC User Pull Concept.[91]

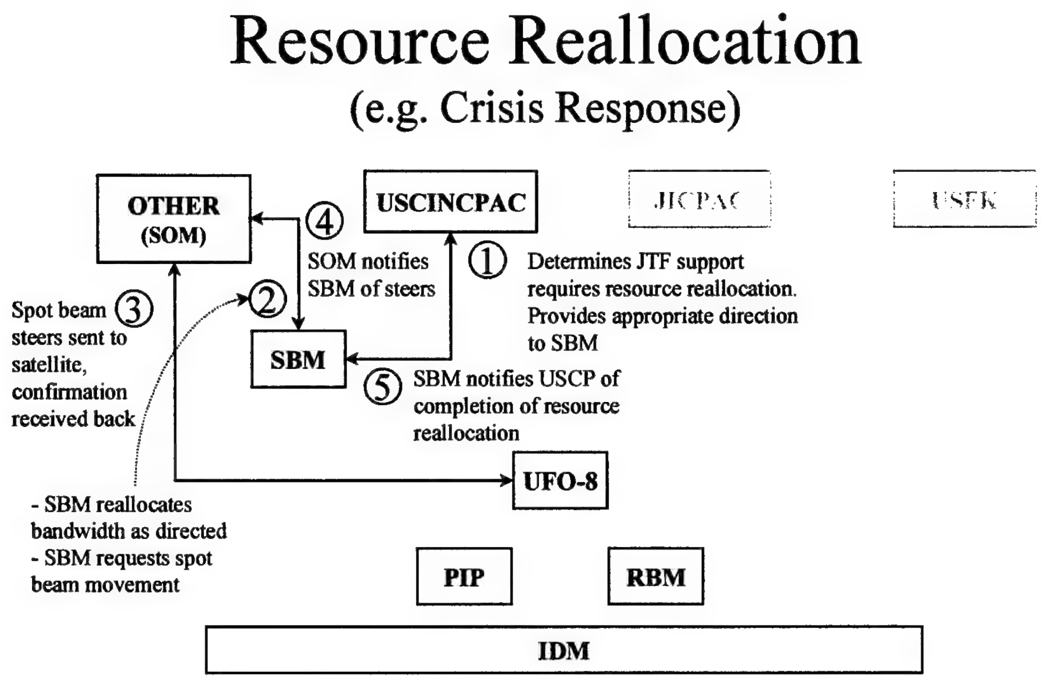


Figure VI-3. JICPAC Crisis Response Concept.[92]

Atlantic Intelligence Center

The Atlantic Intelligence Center (AIC), Norfolk Virginia is the Theater Intelligence Center for USACOM. AIC leadership recognizes the potential for GBS, particularly in GBSs ability to allow the dissemination of multimedia-based intelligence products such as video and audio broadcasts. AIC also recognizes that GBS may prompt revolutionary innovations in the manner in which intelligence is presented to users. Despite their vision on the future of GBS, AIC has no plan for specific intelligence production to support the broadcast.[93]

AIC does not have the production capacity to support the bandwidth offered by GBS. They intend to move into GBS support eventually, in three stages. Initially, they intend to allow normal browsing and user pull. An initial state of dedicated production will begin when they are able to load dedicated video products to the broadcast. Finally,

AIC intends to incorporate new methods of automated production to support GBS.[94]

In a system designed to support push broadcasting, if intelligence centers have few plans for dedicated production, the result will be less than optimal use of the bandwidth. During the Bosnia test of the Joint Broadcast Service, JBS exceeded the production capacity of the various information producers. In some cases, USEUCOM J6 staff searched for products to fill JBS broadcast time.[95]

Challenges for the GBS Dissemination Architecture

The red tape of the IDM process will frustrate users, adding to the workload at both user and producer ends, and slowing the dissemination process. Users must govern the information that is pushed from GBS, and they must do this by writing information need profiles unique to that system.[96] Navy cruisers and submarines, for example, have their intelligence work performed by an E-6 or E-7, sometimes as an additional duty. Accordingly, Battle Group Intelligence Officers will have to consider the inexperience of the subordinate units, and set their GBS profiles appropriately for them. Allowing inexperienced personnel to experiment with profile modification could result in cutting off critical information inadvertently. Because of this concern, and the time involved in creating the profiles, staff intelligence officers are not likely to allow experimentation. To create these user profiles, Navy intelligence staffs will need to modify their "digital OPTASK Intel" during their predeployment training to consider the information needs of the Battle Groups and Amphibious Ready Groups. Although this will add to the workload of deploying staffs, as long as GBS IDM emphases push at the expense of interactive pull architecture, it will have to be done. The intention must be to not let the communications routers make decisions on who gets what information by default, but to

have people with tactical experience drive the dissemination process.[97]

Even when tactical users have been diligent in completing their profile requests, there will be significant problems answering those requests at the theater level. Dissemination managers admit that the automation of repetitive retrieval of known, desired information by profiling or subscription capabilities is immature. Although it should be easy to automate, under the existing architecture, delivering known, recurring products is a labor-intensive process, slowing dissemination.[98]

The situation for "user pull" is little better. The response time for ad-hoc queries is too long, primarily due to the need for information to be handled by people. The IDM leadership acknowledges that the response process needs to be automated.[99]

Problems with "smart push" and "user pull" were discovered during the Bosnia test of the Joint Broadcast Service in May of 1997. The JBS system did not readily support the concepts of "smart push" and "user pull". Although part of the operating concept, software to support this functionality was not developed in time for the test. JBS needed this feature to be operationally useful.[100]

Even with the known problems of dissemination management for GBS, these troublesome procedures are becoming institutionalized as part of the information dissemination management architecture. The USACOM current draft CONOPS for GBS, for example, requires twelve hours of lead-time for producers to schedule and load an ad hoc product. Thus a user would take as much as sixteen hours to satisfy a user-pull request for a twenty-megabyte image. Using existing communications paths the same product could be pulled via Intelink in less than an hour.[101]

Community Architecture Not Supportive

Those who would use GBS to pull information by browsing face several obstacles. The design of the intelligence information architecture DoD-wide effectively limits the amount of information that can be accessed through GBS by browsing. Although the theater Joint Intelligence Centers use web-based information retrieval systems to display both current and archived intelligence, the community as a whole has been slow in taking up the Standard Generalized Markup Language (SGML) standard for intelligence production. SGML, the standard for web documents posted over Intelink, allows users from locations around the world to share reports and access to databases using common browsing software like Netscape Navigator.[102]

Another obstacle users face is one of classification. Major intelligence production centers continue to disseminate COLLATERAL level reports and raw data through the SCI-level Intelink system. Currently, there is no way a collateral-level database can link to an SCI server. The problem is exacerbated by the fact that analysts at major production centers usually only work with SCI-level terminals. The chore of physically moving collateral reports from a SCI circuit to collateral circuit is often left to the theater centers. GBS is not designed to broadcast information classified higher than SECRET.[103]

Even those producers who are working with SGML standards have challenges. For example, JICPAC has many problems with their web-based system encountering broken links to outside servers. JICPACs pages are heavily dependent on links to outside sources of information. However, they experience seventy-to-eighty broken links a day to these valuable sources.[104]

Assuming users are allowed to browse over GBS, and that the information is

available on Intelink for them, some will face physical obstacles blocking their access. In order for users to be able to browse smoothly between GBS, SIPRNet, and their local Intranet data, GBS injection and receive sites must be integrated into local US SECRET and NATO LANs. Doing this allows users to search local information sources, the GBS product catalog, and Intelink from the same terminal. Integrating into LANs would also reduce administrative overhead, eliminating the requirement to manually bridge the "air gap" between systems.[105] In keeping with their concepts of Network Centric Warfare, the Navy intends to install GBS terminals directly into user workstations. The greater preponderance of installations on ships will be to local area networks.[106]

A drawback to integrating GBS into local LANs is the increased load placed on the channel as larger numbers of users utilize the system to pull information. As the number of users drawing on the resource increases even a bandwidth-rich system can be pulled back to a bandwidth-deficient status very quickly.[107]

Decision Makers Resistant to Change

Cultural biases also limit access to information. Within the intelligence community leadership, there remains resistance to allowing low level users open access to major intelligence databases. This is one of the reasons some major centers have been slow to move intelligence databases to formats accessible to the browser-based Intelink. Until these restrictions are relaxed, some information will remain out of reach of tactical users.[108]

Allowing GBS users to pull information challenges current joint doctrine. Low-level users, if allowed to browse freely, will have access to information that might normally be restricted at a higher level. This situation has already occurred, at lower

bandwidths, over Intelink.[109] The proposed information dissemination architecture for GBS in part reflect a need to more effectively control access permissions to information. Information managers want to give local commanders the ability to decide who has access to information, and how much.[110]

Some have charged that the intelligence leadership is resistant to using new media, believing that dedicated intelligence production for high-bandwidth dissemination is a waste of time.[111] During the Bosnia test of the JBS for example, cultural biases at the upper end limited the test and took months to resolve, resulting in an under-utilized new communications channel. [112]

There have been some successes with browser access. USCENTCOM has been able to allow SIPRNet users to access Defense Intelligence Agency (DIA) Modern Integrated DataBase (MIDB) data via their web browsers. Normally access to MIDB requires additional passwords, three days of training to learn Structured Query Language, and access to an SCI-level UNIX terminal. CENTCOM solved the access problem by moving large portions of the MIDB into databases that could be queried through a browser. The results are accessible through Intelink-S, and are CENCTOMs most popular databases.[113]

Conclusions

The proposed dissemination architecture for GBS will require intelligence staffs to manage the flow of information over that system. By using smart push, GBS can efficiently provide identical information to a wide audience. However, since theater intelligence centers have few plans for dedicated production for GBS, bandwidth will likely be underutilized. Low-level users can request information over GBS in the

proposed dissemination architecture, but a lack of automation makes this method of retrieving information less efficient. Users may have the capability to browse for information over Intelink-S using GBS by July of 2000, but CINCS must dedicate a channel for that capability. The existing structure of Intelink-S homepages provided by theater intelligence centers facilitates extracting information by browsing, but the slow adoption of SGML standards DoD-wide, and some cultural resistance to the technology frustrates this process.

VII. CONCLUSION

Theater CINCs must decide how they will use GBS to disseminate information to the consumer. The critical issues affecting naval forces are allocation of GBS physical assets (the spot beams), the amount of bandwidth devoted to scheduled push of information compared to the amount of useful information provided during scheduled programming, and the amount of user browsing allowed over the system.

From the dissemination managers point of view, the utility of broadcasting directly to the warfighter will depend heavily on the managers ability to convince users to curtail unrealistic demands for service, to set priorities for access and for information flow, and adjudicate disputes locally, and to share a small number of satellites.

Intelligence producers must balance the need to provide programming for GBS with the timeless requirement to provide finished intelligence. By continuing to focus on production to their homepages, and by providing scalable products, intelligence centers can serve a wider audience, whatever the communications channel they are using.

GBS is a remarkably simple concept, one based on existing commercial satellite broadcast services. The proposed information management architecture to be used over GBS however is complex and cumbersome. The expected emphasis CINCs will have on push architecture will frustrate users, and is overall an inefficient way to manage information flow over the system at first. Although smart push/user pull has advantages and should provide the bulk of GBS programming, allowing a significant amount of information to be accessed by user browsing will result in the most satisfaction.

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